Alabama Department of Environmental Management

Basin Assessment Site

Rivers and Streams Monitoring Program

2009 Monitoring Summary

Fair

Bear Creek at Conjunction of AL Highways 241 and 172 in Marion County (34.27694/-87.71861)

BACKGROUND

A three mile segment of Bear Creek from the Upper Bear Creek dam downstream to Mill Creek was added to Alabama's Clean Water Act (CWA) §303(d) list of impaired waters in 1998. It was listed for metals, specifically aluminum, from abandoned surface mining. Data collected will be used to establish Total Maximum Daily Loads (TMDLs) for Bear Creek.

The Alabama Department of Environmental Management (ADEM) selected the Bear Creek watershed for biological and water quality monitoring as part of the 2009 Tennessee (TN) Basin Assessment Monitoring. The objectives of this project were to assess the biological integrity of each monitoring site and to estimate overall water quality within the Tennessee River basin.

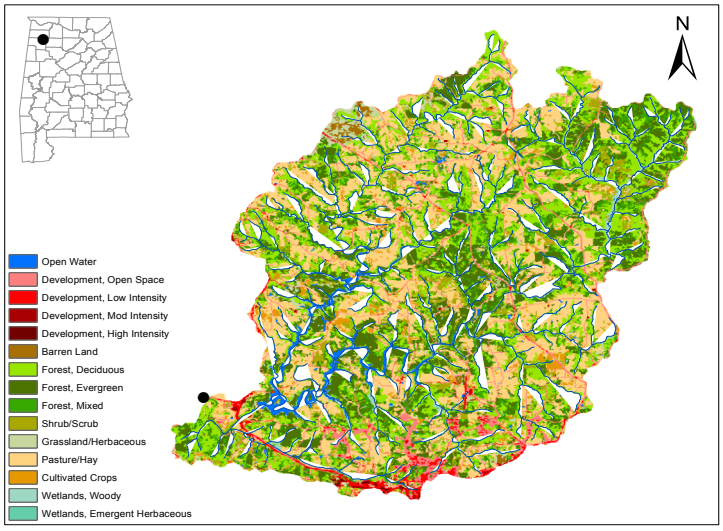

Figure 1. Sampling location and landuse within the Bear Creek watershed at BEA-2.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Bear Creek is a *Swimming (S)/ Fish & Wildlife (F&W)* stream that is located approximately two miles downstream of Upper Bear Creek Reservoir in Marion County. Based on the 2000 National Land Cover Dataset, landuse within the watershed is primarily deciduous forest and pasture (Figure 1). As of February 23, 2011, ADEM's NPDES Management System database shows a total of forty-six permitted discharges within the watershed.

REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Bear Creek at BEA-2 is a high-gradient, riffle-run stream with a bottom substrate dominated by bedrock. Habitat quality and availability was rated as *optimal* for supporting diverse aquatic macroinvertebrate communities. However, a high percentage of bedrock can limit benthic habitat and increase vulnerability of benthic communities to scouring during high flow. There was a high percentage of emergent and rooted emergent aquatic vegetation that created additional habitat.

BIOASSESMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each metric is scored on a 100 point scale. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be characterized by pollution-tolerant taxa groups, indicating *fair* community condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee River
Drainage Area (mi^2)		119
Ecoregion[a]		68e
% Landuse		
Open water		<1
Wetland	Woody	2
	Emergent herbaceous	<1
Forest	Deciduous	25
	Evergreen	15
	Mixed	11
Shrub/scrub		7
Grassland/herbaceous		2
Pasture/hay		26
Cultivated crops		2
Development	Open space	5
	Low intensity	1
	Moderate intensity	<1
	High intensity	<1
Barren		<1
Population/km^2[b]		28
# NPDES Permits[c]	**TOTAL**	46
Construction Stormwater		22
Mining		11
Industrial General		5
Industrial Individual		3
Municipal Individual		5

a.Dissected Plateau

b.2000 US Census

c.#NPDES permits downloaded from ADEM's NPDES Management System database, February 23, 2011

Table 2. Physical characteristics of Bear Creek at BEA-2, June 23, 2009.

Physical Characteristics		
Width (ft)		30
Canopy Cover		Estimate 50/50
Depth (ft)		
	Riffle	0.5
	Run	1.0
	Pool	1.5
% of Reach		
	Riffle	50
	Run	40
	Pool	10
% Substrate		
	Bedrock	73
	Boulder	7
	Cobble	5
	Gravel	6
	Sand	3
	Silt	1
	Organic Matter	5

Table 3. Results of the habitat assessment conducted on Bear Creek at BEA-2, June 23, 2009.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	72	Optimal >70
Sediment Deposition	93	Optimal >70
Sinuosity	90	Optimal >84
Bank and Vegetative Stability	85	Optimal >74
Riparian Buffer	90	Optimal >89
Habitat Assessment Score	**196**	
% Maximum Score	**82**	**Optimal >70**

Table 4. Results of the macroinvertebrate bioassessment conducted in Bear Creek at BEA-2, June 23, 2009

Macroinvertebrate Assessment		
	Results	**Scores**
Taxa richness measures		**(0-100)**
# EPT taxa	17	57
Taxonomic composition measures		
% Non-insect taxa	13	50
% Dominant taxon	19	79
% EPC taxa	17	31
Functional feeding group measures		
% Predators	4	12
Tolerance measures		
% Taxa as Tolerant	25	68
WMB-I Assessment Score	**---**	**49**
WMB-I Assessment Rating		**Fair (39-58)**

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, atrazine, and semi-volatile organics) during March through October of 2009 to help identify any stressors to the biological communities.

Organics were collected at BEA-2 on July 15th and Sept. 9th. All parameters, with the exception of atrazine, were below detection limits. When atrazine was detected (Sept. 9th), heavy rain was reported upstream of the sampling location. Median specific conductance and hardness results were higher than expected for the Dissected Plateau ecoregion. Median dissolved reactive phosphorus, chlorides, total manganese, and dissolved manganese values were also higher than expected for the ecoregion. Arsenic appeared to exceed the human health criteria for four out of eight sampling events. Estimated concentrations of mercury also appear to be elevated.

SUMMARY

Results from the 2009 bioassessment indicated the macroinvertebrate community in Bear Creek at BEA-2 to be in *fair* condition; however, habitat quality and availability was rated as *optimal* for supporting diverse aquatic macroinvertebrate communities. Monitoring should continue to ensure that water quality and biological conditions remain stable.

FOR MORE INFORMATION, CONTACT:
Alicia K. Phillips, ADEM Environmental Indicators Section
1350 Coliseum Boulevard Montgomery, AL 36110
(334) 260-2797 akphillips@adem.state.al.us

Table 5. Summary of water quality data collected March-October, 2009. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL). Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Parameter	N	Min	Max	Med	Avg	SD	Q
Physical							
Temperature (°C)	9	12.3	28.8	22.9	21.3	5.7	
Turbidity (NTU)	9	2.2	53.0	4.6	11.2	16.2	
Total Dissolved Solids (mg/L)	8	43.0	73.0	54.5	54.9	8.8	
J Total Suspended Solids (mg/L)	8	< 0.3	10.0	5.0	4.8	3.0	
Specific Conductance (µmhos)	9	59.0	85.0	75.0 G	72.7	10.4	
Hardness (mg/L)	8	20.2	36.7	26.2 G	26.8	6.5	
Alkalinity (mg/L)	8	8.1	37.5	17.4	20.2	10.5	
Stream Flow (cfs)	5	9.7	18.9	12.3	13.2	3.4	
Chemical							
Dissolved Oxygen (mg/L)	9	7.2	11.1	8.8	8.9	1.3	
pH (su)	9	7.2	8.0	7.5	7.5	0.3	
B Ammonia Nitrogen (mg/L)	3	< 0.006	0.057	0.003	0.021	0.031	
J Nitrate+Nitrite Nitrogen (mg/L)	8	0.100	1.957	0.312	0.518	0.616	
B Total Kjeldahl Nitrogen (mg/L)	3	< 0.089	0.528	0.298	0.290	0.242	
B Total Nitrogen (mg/L)	3	< 0.316	0.628	0.451	0.465	0.157	
J Dissolved Reactive Phosphorus (mg/L)	8	0.009	0.141	0.033 M	0.053	0.048	
B Total Phosphorus (mg/L)	3	0.022	0.057	0.027	0.035	0.019	
J CBOD-5 (mg/L)	8	< 1.0	< 1.0	0.5	0.5	0.0	
Chlorides (mg/L)	8	1.3	5.6	1.9 M	2.3	1.4	
Atrazine (µg/L)	2	< 0.06	0.86	0.44	0.44	0.59	
Total Metals							
J Aluminum (mg/L)	8	< 0.060	2.520	0.114	0.412	0.856	
Iron (mg/L)	8	0.253	1.620	0.470	0.592	0.430	
Manganese (mg/L)	8	0.101	0.343	0.214 M	0.217	0.099	
Dissolved Metals							
J Aluminum (mg/L)	8	< 0.060	0.243	0.030	0.072	0.074	
Antimony (µg/L)	8	< 0.5	6.0	3.0	2.7	1.0	
J Arsenic (µg/L)	8	< 0.4	0.8 H	0.4	0.4	0.3	4
Cadmium (mg/L)	8	< 0.000	< 0.002	0.001	0.001	0.000	
Chromium (mg/L)	8	< 0.007	< 0.007	0.004	0.004	0.000	
Copper (mg/L)	8	< 0.200	< 0.200	0.100 M	0.100	0.000	
J Iron (mg/L)	8	0.112	0.423	0.247	0.244	0.111	
Lead (µg/L)	8	< 1.5	< 1.5	0.8	0.8	0.0	
Manganese (mg/L)	8	0.070	0.332	0.166 M	0.181	0.099	
BJ Mercury (µg/L)	2	< 0.010	0.010 AH	0.010	0.010	0.010	1
Nickel (mg/L)	8	< 0.008	< 0.008	0.004	0.004	0.000	
Selenium (µg/L)	8	< 0.4	< 0.4	0.2	0.2	0.0	
Silver (mg/L)	8	< 0.001	< 0.001	0.000	0.000	0.000	
Thallium (µg/L)	8	< 0.4	< 0.4	0.2	0.2	0.0	
Zinc (mg/L)	8	< 0.060	< 0.060	0.030	0.030	0.000	
Biological							
Chlorophyll a (ug/L)	8	< 1.00	8.01	1.07	1.89	2.53	
J Fecal Coliform (col/100 mL)	8	11	> 600	24	100	203	
J E. coli (col/100mL)	2	39	1414	726	726	972	

A=*F&W* aquatic life use criteria exceeded; B=samples excluded due to laboratory QC concerns; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 68e; H=*F&W* human health criteria exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68e; N=# samples; Q= # of uncertain exceedances.